

KNOWLEDGE ECONOMY AND ENTREPRENEURSHIP ENVIRONMENT IN ROMANIA

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ABSTRACT: It is large consensus that in the today world economy, companies, oriented towards the creation and utilization of knowledge have a competitive advantage. In this sense, it becomes a necessity to continuously monitor the state of research, development and innovation activities and to assess their relationships with the entrepreneurship environment in each economy. This paper aims to emphasize the Romanian entrepreneurship environment capacity to be conducive for determining the sustained economic growth and transition to the knowledge economy. The methodology used the Data Envelopment Analysis the relative efficiency score of the country related to its companies' performance in KE terms. The results obtained reveal the inefficiency of the Romanian entrepreneurship environment on research, development and innovation terms compared to the other selected countries. The study gives an empirical contribution about assessment modalities and analyzes the research and innovation performance within the entrepreneurial environment to substantiate the strategies and policies to accelerate the transition to the new economy based on knowledge.

Keywords: knowledge economy, Data Envelopment Analysis, entrepreneurship environment, research-development

JEL Codes: L26, O11, O32

Background

Knowledge economy is based on a set of values resulted from the use of „grey matter”, which is considered as the main sustainable and renewable resource of a country. In the messages launched by the World Bank Institute (2007) it was stipulated that nowadays, knowledge has become the key driver of competitiveness and both the developed countries and most of the developing countries have to develop policies to address the factors, which can stimulate the progress towards knowledge economy. Among these factors, education is of a special importance but it will generate favourable effects on long-time. For sooner obtaining some economic progresses, one needs to enhance the entrepreneurship environment and its connection with research and innovation activities.

The reality in the developed countries in which knowledge economy is manifested for many years, emphasizes that there is an obvious orientation of firms towards research, development and innovation activities. Science and technology are considered the driver forces lying at the basis of the fast development of industrialized companies (Appleby, 2010). Investments in these fields may ensure increased efficiency and a competitiveness advantage. There is a strong connection between the intensity of scientific research processes, the emergence of new technologies used in order to obtain goods and services and the means of national or regional development. In the measure in which a country has an efficient system of research-development, it has an increased knowledge creation potential, reflected in more productive technologies and in a higher VAT both for

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companies and for the entire economy. In this sense, even for the last twenty years, the knowledge and innovation process were considered as major resources for organizational and societal wealth, creating value for stakeholders (Amidon, 1997).

Numerous studies from special literature present aspects concerning the measuring modalities of knowledge intensity for a sector or country. They refer to determining knowledge-intensive occupations (Wojan, 2000), (Cader, 2008), educational level of the labour force (Raspe and Von Oort, 2008), use of advanced machines and management practices (McGranahan and Beale, 2002), labour force in knowledge-intensive sectors (Elliasson et al., 1990) etc.

More recent theoretical and empirical approaches use for the knowledge capacity evaluation of some countries or regions a group of indicators acting correlatively and are considered essential factors for the economic growth. In the evaluation of knowledge intensity in Dutch economy the following indicators were used: knowledge workers, research-development and innovativeness (Westeren, 2012), (Raspe and Von Oort, 2008). In a study made in USA, a knowledge economy index, which expresses the development through the contribution of the human capital innovation is presented and used. This index was constructed based on the variables: industry expenditure on RD, fast growth firms, venture capital, patents, workforce education, managerial, professional and technical jobs and scientists and engineers (Watkins, 2008).

A means of measuring the returns of human capital is represented by the methodology of the World Bank, which classifies countries according to their capacity of knowledge creation and diffusion (WBI, 2007).

At the European Union level, aspects concerning science, technology and innovation are important elements for realizing the Europe 2020 growth strategy. Therefore, the RD indicators were developed and monitor the objectives of the Innovation Union initiative and European Research Area with a view to improving EU's research and innovation performance (EC, 2012).

As a recently EU integrated country, Romania is profoundly engaged in structural reorganizations in order to fortify the functioning parameters in agreement with Europe's sustainable development vision, in which scientific knowledge, research and innovation are key factors and opportunities for national competitiveness growth.

The questions of this work show how efficient is Romania's RD system as change agent for increasing growth taking as reference the situation of the other EU new countries and how conducive is the enterprise environment for stimulating the progress to the knowledge economy. In this respect, it becomes necessary to appreciate the companies' efficiency in the KE terms with an adequate methodology.

The new model proposed in this paper intends to assess the enterprises' capacity of generating the economic benefits for society, taking into consideration a certain level of technological development and innovative processes. The results obtained revealed some aspects on which the decisional factors could focus their attention in order to stimulate the development of the new, modern and efficient technologies within the entrepreneurship environment.

Data and methodology

An appreciation of research-development system characteristics for EU Accession 10 countries is possible to be made according to the resources engaged in the RD activity, namely: financial resources allotted by the business environment for research, the human capital engaged in the RD activity and the enterprises with innovative activity. The information is offered by EU statistics for the Science, technology and innovation fields and concern three indicators „Business enterprise RD expenditure”, „Total R&D personnel” and „Enterprises with innovation activity” (table 1). These indicators offer a primary image of the research-development potential and they are considered drivers for knowledge creation within an economy (Watkins, 2008).

Table no. 1.

Some RD systems characteristics of the EU accession countries, 2010

Countries	Business enterprise R&D expenditure (BERD), % of GDP	Total R&D personnel, % of total employment	Enterprises with innovation activity (product, process, ongoing or abandoned, organizational and marketing innovation), %
Bulgaria	0.3	0,68	0.2711
Czech Republic	0.96	1,59	0.5169
Estonia	0.82	1,76	0.5684
Latvia	0.22	0,98	0.2986
Lithuania	0.23	1,41	0.3446
Hungary	0.7	1,43	0.3106
Poland	0.2	0,81	0.2814
Romania	0.18	0,42	0.3082
Slovenia	1.42	1,86	0.4940
Slovak Republic	0.27	1,21	0.3559

Source: Eurostat database

Within the considered group, Expenditure of business enterprise for RD registers the lowest level in Romania, of 0.18% of GDP, the maximum of 1.45% being found in Slovenia. For the indicator Total RD personnel, Romania also has the lowest share, 0.42% of total employment. Enterprises with innovation activity in Romania represent 0.30% of total, a little more than the minimum registered in Bulgaria (0.27%). For the last indicators, the maximum registered also in Slovenia (1.86%; 0.49%).

The evaluation of the degree in which the entrepreneurial environment in Romania participates for the knowledge creation and utilisation is a complex problem.

In order to measure the contribution of enterprises in Romania to the RD activity, DEA approach has been used (Charnes et al., 1978) as applied for a homogeneous group of countries, namely, EU Accession 10 countries in the year 2011. The necessary information was taken from the database of the World Economic Forum.

DEA is a linear programming method having the advantage that it can be used in order to determine an optimum solution in the case of diverse variables having an undetermined bond between them. The solution of the model leads to obtaining efficiency scores in using input resources for a number of similar decisional units (DMUs). They allow altogether to find out the position of a DMU by the distance it has towards the efficiency frontier on which, the most performing DMUs are positioned.

The DEA model developed in this paper analyzes the efficiency scores under the constant returns to scale (CRS) assumption and is constructed as an output oriented model. Its general form for k decisional units with n inputs and m outputs is:

$$\begin{aligned} \max \quad & \sum_{j=1}^m v_j y_{kj} \quad \text{s.t.} \quad \sum_{i=1}^n u_i x_{ki} = 1 \quad \sum_{j=1}^m v_j y_{kj} - \sum_{i=1}^n u_i x_{ki} \leq 0 \quad (1) \\ & \forall u_i, v_j \geq 0 \end{aligned}$$

in which, u_i represent the weights of inputs (x);
 v_j are the weights of outputs (y).

For the empirical observations of the inputs and output variables considered in analysis, the model proposed is:

$$GDP_k = f(TR_k, BS_k, IN_k) \quad (2)$$

where: GDP_k represents the gross domestic product per capital in the country k;

TR_k - score of the technological readiness;

BS_k - score of the business sophistication;

IN_k - score of the innovation.

In this paper, the DEA model, proposed for the entrepreneurship environment evaluation according to the knowledge process for the group of countries, uses as inputs variables the „Technological readiness”, „Business sophistication”, „Innovation” indicators and the indicator „Gross Domestic Product per inhabitant” as output variable (table2).

Input indicators were selected in analysis due to the economic signification they have and the contribution brought to the growth enhancing in KE terms. They represent scores registered by each country on three pillars on a scale from 1 to 7. These indicators enter in the compoence of the Global Competitiveness Index calculated (on the basis of 12 pillars) and annually reported by the World Economic Forum (WEF, 2012).

Table no. 2.

Entrepreneurship environment and RD processes, EU Accession 10 countries, 2011

Countries	Gross domestic product at market prices, (PPS per inhabitant)	Technological readiness (1-7 best)	Business sophistication (1-7 best)	Innovation (1-7 best)
Bulgaria	11600	4.30	3.62	2.98
Czech Republic	20200	5.06	4.45	3.81
Estonia	16900	5.29	4.20	3.93
Latvia	14700	4.73	3.89	3.25
Lithuania	16600	5.00	4.16	3.51
Hungary	16500	4.43	3.74	3.61
Poland	16200	4.66	4.06	3.25
Romania	11400*	4.09	3.47	2.92
Slovenia	21000	4.96	4.18	3.85
Slovak Republic	18400	4.46	4.02	2.98

Source: Eurostat database; World Economic Forum data platform

For the year 2010 Romania has a GDP of 11400 PPS/inhabitant. The indicator growth with 9.6% in comparison to 2007, does not ensure, however, but the last place in what the economic development is concerned, the highest GDP/inhabitant being found in Slovenia. In the same position it is found when we talk about the innovative activity and technological development.

Results and discussions

The solution of the DEA model generated the efficiency shares of the RD activity, specific to the selected 10 state economies that have recently acceded to EU. The efficiency rates have a relative size being determined by comparison with the best usage of resources synthesized within the three pillars. The shares level depends on the inputs dimension contributing to obtaining a

certain level of GDP/capital and the combination between these. The results may be found in table no.3.

Table no. 3.

The economic performance of entrepreneurship on RD, EU 10 countries, 2011

Country	Performance score	Situation
Bulgaria	0.670	inefficient
Czech Republic	0.948	inefficient
Estonia	0.801	inefficient
Latvia	0.785	inefficient
Lithuania	0.826	inefficient
Hungary	0.880	inefficient
Poland	0.845	inefficient
Romania	0.668	inefficient
Slovenia	1.000	efficient
Slovak Republic	1.000	efficient
Mean- EU 10 members	0.842	-

Source: DEAP soft

The frontier of obtained efficiency is presented in figure 1. For the year 2011, the highest RD system performance from the enterprises environment, according to the considered variables, has been registered in Slovenia and Slovak Republic, and they form the reference system for the other countries. At short distance from the efficiency frontier, we may find the Czech Republic. Romania has registered a score of 66.8%, which positions it on the last place in the EU Accession 10 countries group. The RD activity performance of enterprises is below the average competitiveness registered on the overall analyzed states and more reduced with 33.2% compared to the group performers. The situation signals the fact that at present, Romanian enterprises, looked upon through the prism of characteristics required by knowledge economy have a low capacity to contribute to the economic growth. In a hypothesis of optimizing their functioning according to the entrepreneurship environment model in Slovenia and Slovak Republic, the GDP per inhabitant level should reach 17000 euro PPS, namely grow in comparison to the actual (2010) with approximately 49%.

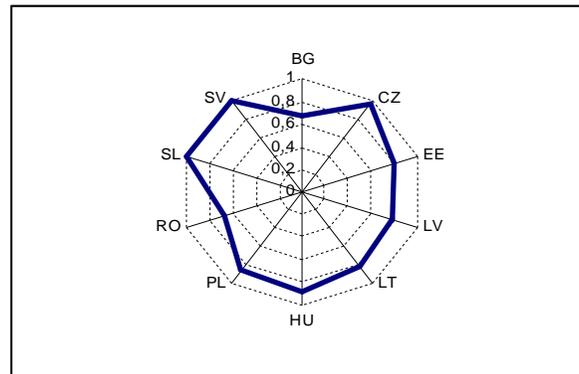


Figure no. 1. - Efficiency frontier of enterprises on RD, EU new Member States, 2011

Explaining the inefficiency causes of research, development and innovation from enterprises in Romania needs the study of some analytical indicators, significant in the processes of knowledge creation and lying at the basis of calculating the three pillars (9, 11 and 12) (WEF, 2012). Among these, especially business sophistication and innovation factors are increasingly essential for

developing new technologies, necessary to enterprises in order to increase efficiency and competitiveness.

a. A field having an important role in the processes of knowledge creation and usage within the entrepreneurship environment is business sophistication.

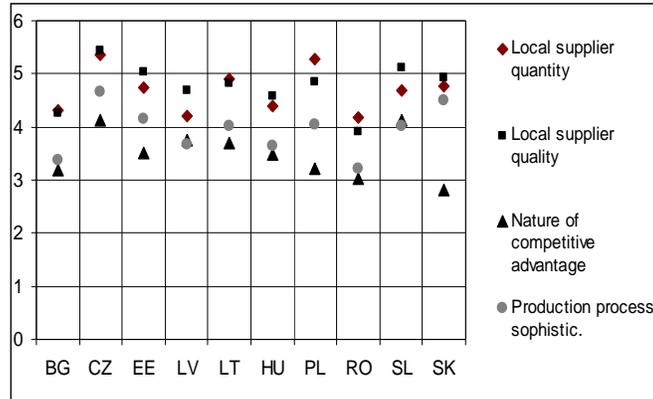


Figure no. 2. - Business sophistication, EU 10 countries, 2011

In Romania, the business sophistication practices are limited and we might observe a falling behind in comparison to the other EU members (figure 2). Generally, the sophistication factors contribute to the growth of efficiency production and modernization of business sectors and next to innovation they are key factors defining innovation-driven economies. Within the group of countries finding themselves in this advanced stage of development the Czech Republic, Slovak Republic și Slovenia are outstanding.

Romania’s economy has a low number of local suppliers and the quality of their operations and strategies is little enough (117 and 112 positions), the source of enterprise competitiveness especially being given by the low costs of resources and by the usage of natural resources. Within the enterprises the orientation towards unique products and processes lacks (score 3.02 out of 7), the production process sophistication is, in conclusion reduced (score 3.21 and 103 position), which means that labour-intensive methods or previous generation of technologies especially prevail.

b. The innovative factors represent elements strongly stimulating economic progress by orienting firms towards higher value added activities. In this field too, there are big differences between Romania and the other EU new member states (figure 3).

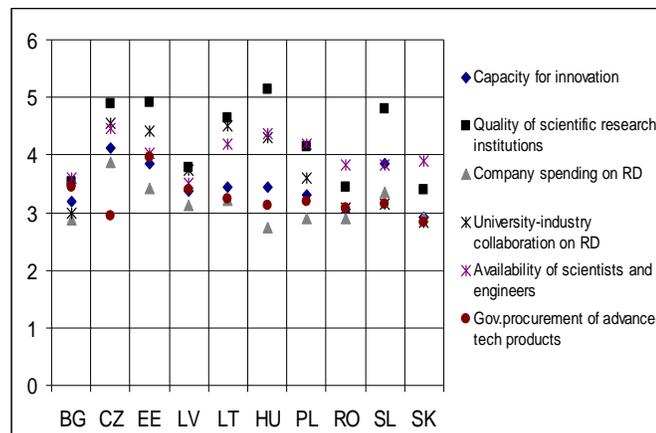


Figure no. 3. Innovation, EU 10 countries, 2011

In what the human capital, available for scientific research is concerned, Romania disposes of a number of scientists and engineers close to the one of Slovenia and Slovak Republic but lower with 15% compared to the Czech Republic, the latter being the first within EU new member states.

Quality of scientific research institutions is also very close to many countries from the analyzed group; however, it is lower with 33% in comparison to the country with the best situation in the group (Hungary). A possible explanation may be the insufficient collaboration between the university environment and the industrial sector regarding the creation of knowledge and its application in order to realize new technological developments. The particularly small number of patents application (1.89 patents/million population) in Romania also illustrates this.

Governmental expenses for procurement of the advanced technologies or products are of nature to stimulate the research, development and innovation activity and represent a means of progress towards a sustainable growth. The best implication of the public sector in the RD financing belongs to Estonia, while in Romania the government allots 23% less for purchasing innovative products.

In a country, the adequate functioning of RD activity depends in a greater measure than companies spending in this field. The private sector in Romania has a better implication in financing scientific research than the public sector but in comparison with the first classified within the group of 10 states (the Czech Republic), the level of expenses is lower with 26%.

c. Romania has an acceptable technological level development (59 place), but presents the least score among the 10 countries. The causes of this disadvantageous situation are suggested by elements of nature to influence the level of technological readiness (figure 4).

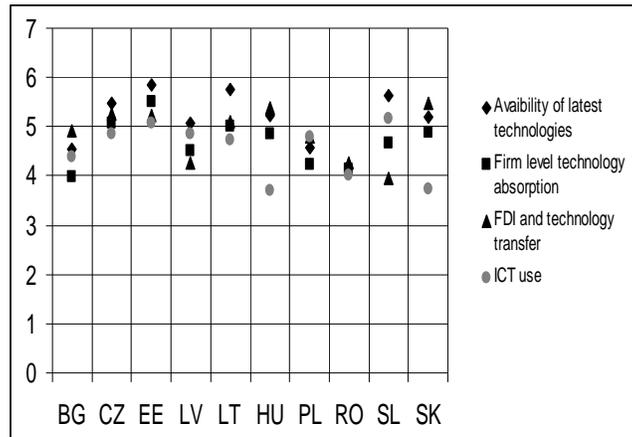


Figure no. 4. - Technological readiness, EU 10 countries, 2011

The business entrepreneurship in Romania has a low technological development level of production processes, which explains in a great deal the new value created in economy, lower than the other countries'. One of the causes may seem the fact the enterprises have no access to the latest technologies developed within the country or come from outside in order to increase its productivity. Foreign direct investments are reduced, so that this source of technological transfer does not facilitate the improvement of enterprise competitiveness. The use of ICT level is better (45 place), within the 10 countries group, Romania overcoming Hungary and Slovak Republic. Information and communication technologies have an important role in interconnecting all sectors and activities in economy and constitute the base element of the access to information and knowledge necessary to production efficiency and growth.

An overall image of the entrepreneurship environment in Romania is outlined from the enterprised analysis, and this, compared to the other EU countries has a low performance in KE terms. For the moment, their contribution to the economic growth focuses on traditional factors and

in a very little measure on business sophistication and innovation factors. The obtained results present a few characteristics of the enterprises.

Among the favourable characteristics, we may mention the fact that: the companies have an acceptable level of technological readiness and especially there are good possibilities of acquiring and disseminating a scientific knowledge because informational infrastructure is developed well enough.

Nevertheless, there are unfavourable aspects, the insufficient capacity of enterprises to stimulate research and transition towards knowledge economy being remarked. They insufficiently finance RD, have a reduced innovation potential, do not develop new production technologies and collaboration with academic research institutions is low.

The obtained results demonstrate that in the knowledge economy traits analysis context, the growth of enterprise productive capacity is strongly connected to technological development and especially, to business sophistication and innovation enhancement.

The decisional factors should address not only to traditional production factors – capital and equipment- but especially information and knowledge assets which are increasingly important. In this way, companies will succeed in their transformation into knowledge-based firms (Jarboe, 2001).

The knowledge-based companies have a few basic characteristics (Zack, 2003), (Cader, 2008), which must be taken into consideration also by Romanian enterprises in the activity restructuring, stimulation or reorientation.

- next to production processes, information and processes of knowledge sharing and creation are important in order to obtain goods and services, so that investments in learning or ICT become key resources in obtaining a competitive advantage;

- knowledge boundaries are flexible and dynamic, meaning that company is viewed as a set of people and resources capable to create and apply knowledge about products, customers, applications, technologies etc in a continuous interaction;

- besides the existence of a good knowledge management process, the companies need an adequate strategy focusing internally and externally to knowing what are the elements that can be used for increasing the efficiency;

- the creation of a knowledge-oriented image, meaning that all operations and activities are considered a potential knowledge enhancer.

These are means by which the enterprises may introduce changes in their activities, so that they produce goods and services, which have knowledge at their core and operate more efficiently. .

Conclusions

The progress of a country towards an economy based on knowledge depends on the efficient functioning of factors, strongly connected to knowledge creation processes namely in synthesis, education sector, research, development and innovation system, and ICT infrastructure. The existence of a good correlation between the enterprise activity and RD environment stimulates economy modernisation and its competitiveness growth.

The paper presented a suitable approach in analyzing the capacity of entrepreneurship environment to stimulate the creation and application of knowledge in order to result a sustainable economic growth.

The use of DEA methodology, employing some synthesis indicators and the detailed analysis of their components led to the assert that Romania entrepreneurship environment seen through the lenses of knowledge creation is not efficient in comparison with the other EU new member states. It cannot yet ensure the high value added for economy, Romania being ranked the last in the group, depending on the level of gross domestic product per inhabitant and the last, depending on the relative efficiency of the all innovation, sophistication and technological factors, which corresponds to the country profile made by the World Economic Forum (2012).

The improvement of enterprise contribution to research, development and innovation involves transforming enterprises into knowledge-based companies by: learning investments, ICT development, employees interaction stimulation within the intern and extern environment in order to extend knowledge boundaries, improve the knowledge management process and formulate adequate strategies in order to create a knowledge-oriented image.

The consideration of these elements as real opportunities for performance growth and competitiveness in the entrepreneurship environment imposes on the Romanian enterprises the rethinking of economic processes and the transition acceleration towards the business model based on knowledge.

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